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The proceedings include seven selected papers. In one, Brewster S. Miller reports on the 1968 activities of the Medical and Scientific Department of the United Cerebral Palsy Associations. In another, James J. Gallagher anticipates the next 20 years in special education for the handicapped. Also considered are the following topics: new directions for the next 20 years of research, by Sidney Farber; a blueprint for prevention, by William Berenberg; control of infections contributing to brain dysfunction, by Louis Z. Cooper; more effective use of today's knowledge in better prenatal care, by Frederick C. Battaglia; and intrauterine diagnosis of fetal abnormality, by Henry L. Nadler. (JD)

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SELECTED PAPERS

FROM

PROFESSIONAL PROGRAM SEGMENTS

OF

UNITED CEREBRAL PALSY'S ANNUAL CONFERENCE

WASHINGTON, D.C.

March 6-8, 1969

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*Investigators on a UCP supported grant

REPORT OF THE MEDICAL AND SCIENTIFIC DEPARTMENT

1968

BREWSTER S. MILLER, M.D.
MEDICAL DIRECTOR
UNITED CEREBRAL PALSY ASSOCIATIONS, INC.
NEW YORK, N.Y.

PRESENTED AT

ANNUAL CONFERENCE, UNITED CEREBRAL PALSY ASSOCIATIONS, INC.

STATLER HILTON HOTEL, WASHINGTON, D.C.

We meet together, after twenty years, at a time of special opportunity. Frankly, time does not permit a reflective review of United Cerebral Palsy's medical and scientific activities in the past two decades. It is good that this is so. The maturing of UCP's program, the improvement in medical, educational and vocational care of children and adults with brain dysfunction, and the productive research supported by this agency are exciting hallmarks of 1949 to 1969, and we have described them to you in the past.

But we are in a period of rapid social, cultural and economic turmoil and I feel that we can be perceptive and skillful enough to make this change pay off for those children and adults whom we are dedicated to serve. John Gardner has put it quite succinctly when he says that:

> "...the development of resistance to new ideas is a familiar process in the individual. The infant is a model of openness to new experience -- receptive, curious, eager, unafraid, willing to try anything. As years pass, these priceless qualities fade. He becomes more cautious, less eager, and accumulates deeply rooted habits and fixed attitudes."

"The same process may be observed in organizations. The young organization is willing to experiment with a variety of ways to solve its problems. It is not bowed by the weight of tradition. It rushes in where angels fear to tread. As it matures, it develops settled policies and habitual modes of solving problems. In doing so, it becomes more efficient, but also less flexible, less willing to look freshly into each day's experience. Its increasingly fixed routines and practices are congealed in an elaborate body of written rules. In the final stage of organization senility, there is a rule or precedent for everything. Someone has said that the last act of a dying organization is to get out a new and enlarged edition of the rule book.

As society, and the organizations of which it is made, becomes more concerned with precedent and custom, it comes to care more about how things get done and less about whether they are done. The man who wins acclaim is not the one "who gets things done" but the one who has an ingrained knowledge of the rules and accepted practices. Whether he accomplishes anything becomes less important than whether he conducts himself in an "appropriate" manner. Thus, do men become prisoners of their procedures."

These words have applicability for us in UCP. We have studied our service program in the past two years by a series of Regional Service Program Hearings and by the very large number of Affiliate Board, staff and professional advisory discussions leading up to them. These have formed the basis of the IHF Plan - The Individual with Cerebral Palsy and His Family - approved by the Operating Board of Officers and Executive Committee. This is our blueprint for future action. . . not National, not Affiliate, but together, we have the opportunity to make our services more meaningful and effective.

I shall not review the Plan, which has clear emphasis and priority action for the total agency and which essentially comes from grass roots service needs - but I hope that each Board member and each staff person has carefully studied it and recognizes its implications for the future of United Cerebral Palsy. We shall make this the focus of the service program discussion at the 1969 fall Regional Conferences. I am pleased to report that we have assembled talented and concerned lay and professional workers from all over the country to constitute United Cerebral Palsy Task Forces to help all of us in transmitting this objective into concerted service action.

For we must recognize that service to the cerebral palsied child and adult is the most sustaining thing that we can do. I do not say that it will prevent cerebral palsy - research will do that. I do not say that it will increase volunteer participation in all phases of the program - education will do that. But until a few more years shall roll and we can solve the riddle of prevention for all children and we can broaden the base of people involvement in this cause, we shall do well to reach out to our handicapped child with the warm hands of service.

So we must be willing to change our concepts of our service programming as we know it today. I wish to pinpoint one of the basic principles of service in the Plan which has important implications for our programming in communities:

> Local affiliates should recognize that new service programs are needed and must be initiated as present services are assumed by other private or public agencies or when additional funds become available. It should be a major objective of an affiliate to stimulate

other agencies to provide more services of the highest quality for individuals with cerebral palsy. Affiliates can demonstrate their willingness to be flexible in their approach and structure for service program development.

By and large, we have not had success in the formation of Medical-Professional Advisory Boards. About one-third of our Affiliates have active, functioning, useful Committees, one-third have such a Board on paper only and the remainder have none at all. With our new program and National's new Professional Service Program Committee, a standing committee of the Board of Directors, we shall urge that each Affiliate pattern its local professional advisory structure along identical lines with proper representation from medicine, special education, vocational habilitation, administration, nursing, and, indeed, each scientific discipline relating to cerebral palsy. This is essential if our future efforts are to be professionally sound and can attract the respect and participation of the community.

We need people to become involved, for, again, as Mr. Gardner has observed, "I constantly marvel at the number of people outside the area of action who know precisely how to solve our problems, and the number of people in the heat of action who lack that superhuman quality."

We must point out here that for the first time United Cerebral Palsy, as an organization, is thinking clearly about the total family wherein a cerebral palsied individual resides and is becoming and is becoming concerned with prevention of brain dysfunction in sociological terms involving the family and community. We are to establish a life-time partnership between an Affiliate and a family once contact has been made, and the Affiliate will serve as a permanent resource for service, information and guidance for this family.

This means that we must try very hard to include the "disemployed" - the severely disabled at home and in state institutions - into the mainstream of life to give these handicapped children a sense of purpose and dignity to their most difficult lives. And, the time is now - this group has been far too long neglected! As Carlyle has so eloquently put it, "Our main business is, not to see what lies dimly at a distance, but to do what lies clearly at hand." Yes, the time is now!

In attempting to characterize the activities of your National Medical Department staff in its activities this past year - assisting Affiliates, representing UCP in a variety of meetings, studies and discussions, administering and stimulating service, special education and research, I was reminded of the quotation I used in the first series of Regional Meetings, in which I had the privilege of participating when I joined your staff in 1958.

> "I shall pass through this world but once;
> any good thing therefore that I can do,
> or any kindness that I can show to
> any human being, let me do it now,
> let me not defer it, nor neglect it,
> for I shall not pass this way again."

This is our real objective. Is it yours?

During the year, your Medical Director spent 108 man-days in the field, in a variety of activities - meeting with Affiliate Medical-Professional Advisory Boards, speaking to Affiliate Annual Meetings, being a member of an Affiliate Study Team, representing UCP on the National Committee for Research in Neurological Disorders, the American Academy for Cerebral Palsy, etc., and a host of other functions to help in the coordination of our respective efforts.

Although the National Committee for Research in Neurological Disorders attempted to increase the Federal government's allocations for brain and nervous system research by testimony of experts for the "citizen's budget", it was not possible this year. The freeze is on in Washington and this makes it especially difficult for laboratory scientists who have ongoing programs. However, it is noteworthy to observe that the budget for research for the National Institute for Neurological Diseases and Stroke has taken a six-fold jump from $21,387,000 in 1958-59 to $128,934,000 in 1968-69. We feel it essential to contrive to educate legislators to the great needs in the field, especially in the area of training young neurologists and neurological investigators.

In the field of brain damage, UCP's Research Foundation has pioneered in several areas - the awards of United Cerebral Palsy - Dwight D. Eisenhower Clinical Professorships in medical schools; UCP Senior Clinical Fellowships for American Specialty Board qualified physicians; UCP Small Grants in amount up to $2,500 to enable research to get started or to design a study; cooperative programming with the American Speech and Hearing Foundation for the award of fellowships in speech and hearing for doctoral candidates; travel grants to enable UCP Clinical Fellows to participate in the Annual Meeting of the American Academy for Cerebral Palsy; and the joint Postdoctoral Research Fellowship program with the International Brain Research Organization.

Paralleling the change in UCP Service program efforts, the Foundation's program of focussing its funds on the stimulation and support of research having relevance to causative factors in brain dysfunction has been started. Much of the past year has been completing payments on long-term studies approved by the Board of Directors. Last month, the first Foundation Task Force of distinguished investigators met in Boston to develop specific directions for cooperative research in many institutions supported by UCP, especially in the areas of prematurity, blood group incompatibilities, neurotropic viruses, such as rubella, and better obstetrical and pediatric care.

The Foundation's Steering Committee is still considering several very important research needs and we expect the first grants to be awarded shortly. I fear, however, that the Foundation's real objective here may be delayed because of the need for additional funds to solve the key problem of prevention of cerebral palsy. Are we, UCP and government, really allocating enough for scientific research in this field?

As a nation we spend more than twice as much on forest protection and utilization programs than we do to solve the riddle of the damaged human brain. Consider our priorities here, for we spend:

1 1/2 times as much on fish and wildlife services
1 1/2 times as much on hair sprays
2 times as much on shampoos
2 times as much on ball point pens
1 1/2 times as much on face creams
5 times as much on greeting cards
70 times as much on tobacco;

than we do on research which could prevent cerebral palsy and related neurological disorders of children. So, we have a problem of what is most urgently needed and tremendous public education.

One of the real dividends in the support of research investigations by the Voluntary Health Agency is its flexibility. It can see a problem and move in with all its resources, as it is starting to do in the area of prevention now. But, in 1962, the Foundation supported the work of Nobel Laureate Thomas Weller and Franklin Neva at Harvard, who, with Dr. Parkman and his colleagues at Walter Reed Hospital, here in Washington, succeeded in isolating the rubella or German measles virus. From this work, Drs. Meyer and Parkman developed an experimental vaccine which we expect will be licensed in a few months. We shall be actively participating with state and community health departments, other private agencies and practicing physicians in a large scale immunization program to vaccinate all preschool and school-age children to prevent the disease and its spread to pregnant women. It is most appropriate that we honor Drs. Meyer and Parkman, this year, by the UCP-Max Weinstein Award to each of these fine young men.

Work presented at the American Academy for Cerebral Palsy for the Perinatal Collaborative Study and from Columbia University has shown the importance of grasp and suck in the newborn, which, together with the Apgar score recording tone, color, respiration and heart rate, will make it possible to predict with accuracy the subsequent neurological integrity of the infant. Certainly, the detection and careful follow along of high suspect infants is of vital importance to UCP and the new evolving service program on prevention will pay real dividends here.

The problem of premature delivery is a single focus to which UCP research efforts can turn its attention at once. At the Academy meeting, Dr. Berenberg presented startling figures. He stated that, based on Alison MacDonald's data, the incidence of cerebral palsy in newborns weighing four pounds or less is sixty times that encountered in liveborn infants of all weights. Dr. Clifford, at the Boston Lying-In Hospital, reported a truly significant drop in neonatal mortality over the 20-year period 1943-1963, with the greatest reduction in babies over four pounds while the death rate for prematures remained essentially unchanged. He pointed out an increase in premature births from 6% to 9% in the same two decades and the explanation may be a more successful attack or infertility with resultant higher frequency of decreased length of gestation.

Dr. Berenberg also highlighted the striking correlation between prematurity and the spastic paraplegic variety of cerebral palsy. Various investigators have reported this incidence from 60% to 81% premature delivery in cases of spastic paraplegia contrasted with 29% incidence of premature delivery in quadriplegia. From the 30th to the 37th week of pregnancy, each two weeks which the fetus spends _in utero_ reduces his chances of developing spastic paraplegia by 10%. This is such a striking figure that, within the limits of safety for other reasons, every possible attempt should be made to keep the child _in utero_ as long as possible up to the 37th week, when the statistical association between prematurity and spastic paraplegia falls off sharply.

In connection with our new program efforts, we should recall Dr. Perlstein's important study supported by UCP of Greater Chicago on the causative factors in postnatally acquired cerebral palsy. Fourteen per cent of his series had acquired brain dysfunction with athetoids accounting for 5% and 38% of these acquired were spastic hemiplegias. The most common category in his group was the result of infection and toxic encephalitis (57%) with skull trauma at 18%, meningitis at 12% and vascular accidents 8%, a much lower incidence than in geriatric strokes.

In Perlstein's series spasticity was present in 76% of the acquired cerebral palsied patients contrasted with 56% of the congenital. The type of cerebral palsy also varied with the nature of the acquired cause. For example, the vascular group (simulating the incidence of geriatric stroke patients) had the highest incidence of spastics (96%) with three out of four being hemiplegic. Brain infections accounted for the lowest number of spastics (68%) with less than half being hemiplegic. Skull injuries and meningitis were intermediate between these two groups. On the other hand, dyskinetic syndromes were twice as frequent in patients with brain infections (35%) as in skull trauma (18%). Ataxia was four times as frequent following skull injury and brain infection than after vascular accidents.

So, an important part of UCP's new preventive service program is the public education emphasis on control of infections, the uses of vaccines for measles, mumps, influenza, etc., the use of seat belts and head protective devices for motorcycle riders and many other preventive measures to reduce the incidence of these important causes of cerebral palsy by acquisition.

You have a particularly outstanding staff in the Medical Department. They are true professionals and I am very proud of each of them.

Dr. Robinault's duties as Coordinator of Professional Activities at National are wide and diverse. Her skillfully developed "UCP Manual on Functional Aids and Equipment" is nearing completion. A publisher has been selected and we are attempting to procure subsidy in order to make this volume widely available at a modest price. She has reviewed several books and edited a large number of UCP publications while representing you at several institutes and meetings, such as the National Health Council Committee on Continuing Education, at a meeting of the U.S. Department of Labor to determine how the Fair Labor Standards Act can be applied to sheltered workshops, planning with the Child Study Association for the 1970 White House Conference on Children and Youth, etc. She has surveyed Affiliate prenursery programs and is accumulating data which will be helpful to all Affiliates in programming for this useful service for handicapped children.

The staff of your Service Section, ably directed by Mr. Messner, our organizer and administrator par excellence, spent 332 days in the field last year:

Service program evaluations (2 state and 9 community Affiliates)	89 days
Consultation for 18 state and local affiliates	33 days
Workshops & Seminars in 19 different localities	35 days
Regional Hearings	42 days
Other State and National Meetings of UCP or related organizations	133 days.

A large percentage of the staff time has been spent in developing and collating the material for the IHF Plan and starting to implement its recommendations. Task Forces have been appointed by the President and will be meeting in the next few months to develop specific program directions which will require active involvement by all Affiliates. We must develop better community services for young adults with cerebral palsy who do not work, prevention, children with related brain dysfunction and the all important information, referral and follow-along services.

New York University has continued to use our National Office and nearby affiliates as an interne training ground for students in community organization. This program has been carefully developed and supervised by Mr. Weinrich. His first trainee became so enthusiastic about the social problems of cerebral palsied families that she plans to enter this phase of social work as a career.

The National organization has received a small grant from the Division of Mental Retardation of the Social and Rehabilitation Service to match some of our own money, plus a grant from the National Association for Retarded Children, for the purpose of developing a set of guidelines for standards of care for patients living in state institutions for the retarded, who are also physically disabled. Since, as many as 40% of all residents can be so classified, and many of them are cerebral palsied, this project has great potential for future improvement of care.

We are currently working on a similar grant from the Division of Mental Retardation and the National Association for Retarded Children to develop a curriculum for training of contact care personnel in residential facilities and day care facilities, particularly those serving the more severely and multiply involved. The first course will be offered by the University of Wisconsin this coming summer and will involve nurses, occupational therapists and physical therapists from several residential institutions. Out of this could come a mass of curriculum materials that could be used in undergraduate training of these professionals, as well as in others in the field.

United Cerebral Palsy is one of the national agencies involved in the National Planning Committee on Accreditation of Facilities for the Mentally Retarded. This planning has been done with a grant from the Division of Mental Retardation and a request is pending with the Social and Rehabilitation Service for a three-year grant to establish and operate the agency. Again, this has great potential for improvement of services to the mentally retarded including those with cerebral palsy.

Our effective and peripatetic nurse consultant, Mrs. Haynes, continues to make a tremendous impact on the field. During the year, the video-tapes and kinescopes made at the Indiana University School of Nursing on case-finding and nursing appraisal of neurological maturation received the endorsement of the National League for Nursing and the American Nursing Association. In addition, I am pleased to report that they have been accepted by the Network for Continuing Education for their national programs.

Mrs. Haynes' paper on nursing approaches in the care of infants with multiple handicaps was solicited by the American Journal of Nursing and published in October, 1968. We are gratified at the large number of requests for reprints which have been made.

UCP's interest in improvement of services for residents with multiple handicaps in state institutions received additional endorsement and support in 1968. A three-way grant (NARC, MR Division and UCP) has made possible the activation of a committee to devise a new curriculum for the intensive training of nurse-therapy teams from state institutions. This curriculum will be tested out on four such teams during one month of intensive training at the Central Wisconsin Hospital and Training School during July and August 1969. Support of the Trainees, plus faculty participation, is being made possible by an adjunctive grant from the University of Wisconsin.

Active planning took place during 1968 for a program to be held in April, 1969, for one week at Indiana University, whereby a corps of specially trained nurses will be created and activated as a resource, upon which affiliates can call for participation in seminars; consultation with clinics, home service and other personnel interest in the improvement of nursing care of patients with multiple handicaps. These nurses will be particularly knowledgeable and skillful in nursing techniques to enhance early recognition of the symptoms of cerebral dysfunction. Therefore, they should prove particularly useful as consultants to public health nursing agencies, nurses working in the newborn nursery, etc.

UCP's total program continues to have international rammifications. Visitors to our National Office come from Spain, Lebanon, Scotland, Japan, Australia, Argentina, the Netherlands, Mexico, Germany, India and Italy. UCP's advice was sought in developing new programs in many areas of the globe and it continues to work closely with the World Commission for Cerebral Palsy of the International Society for Rehabilitation of the Disabled. Your Medical Director continues as Secretary of the Commission, which is now active in developing a Technical Assistance program for less well-developed countries who wish to start services for cerebral palsied children and adults.

Mrs. Jack Hausman, one of UCP's founders and most active volunteers, led a UCP delegation to the Pan Pacific Conference in Hong Kong last September. She made a particularly useful contribution to its nonmedical seminar in illustrating the vital role that informed and dedicated volunteers play in voluntary health agency efforts. This is a relatively new concept for our colleagues in the Far East and we have started closer cooperative efforts with many groups in Thailand, Indonesia, the Philippines and Formosa.

What does all this broad and stimulating program add up to for UCP? We have matured greatly in the past two decades and our efforts in cerebral palsy now cover the world. The involvement and personal commitment of workers for those less fortunate than ourselves reflects a nobility of character which makes their work valuable and important. But, we must reach out to more American citizens and show them the satisfactions of being a part of this cause. It is in our reach and theirs. The philosopher, Seneca, aptly pinpointed this need when he wrote: "Men do not care how nobly they live, but only how long. Although it is within the reach of every man to live nobly, but within no man's power to live long."

So we must live one day at a time and make our contribution to those who need us and our knowledge and skills, with our love and total commitment. Actually, this is what life asks - live one day at a time and live it well. There are so many around us who are hurt and who bear burdens - and who need loving care. This is what United Cerebral Palsy is all about.

But once I pass this way,
And then - no more.
But once - and then, the silent door
Swings on its hinges, --
Opens . . . closes, --
And no more
I pass this way.
So, while I may,
With all my might,
I will essay
Sweet comfort and delight
To all I meet upon the Pilgrim Way.
For no man travels twice
the Great Highway
That climbs through Darkness up to Light, --
Through Night
To Day.

.... John Oxenham

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CRYSTAL-GAZING THE NEXT TWENTY YEARS
IN SPECIAL EDUCATION FOR HANDICAPPED CHILDREN

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ANNUAL CONFERENCE, UNITED CEREBRAL PALSY ASSOCIATIONS, INC.
STATLER HILTON HOTEL, WASHINGTON, D.C., THURSDAY, MARCH 6, 1969

One of the things that is very clear about the attitude of both the general -- Federal government and State government, and local government in regard to education of handicapped children is a completely new philosophy. It is going away from an older concept of compassion and care, and protection, and going to a much newer and more viable concept of maximizing opportunities for handicapped youngsters, and one of the reasons why the Federal government has increased markedly in its support of these programs, one of the reasons why you see expansion at the State and local areas in education of handicapped children is that they have begun to catch this concept and run with it.

But it is a sobering thought that the present six-year-old handicapped child that now enters school, will leave school in 1980 or later, and that the world in which this youngster will make an adjustment will have changed radically from the one we know today. If we are to plan effectively for change, which is inevitable, we must be aware of the major dimensions that can be reasonably predicted on the basis of what visible trends face us today, because long-range planning in the development of future programs must consider not only our present problems, but what the state of the school, family and society will be like at some future time point, and certainly some things that we can say -- and prediction is not really a hard business to be in, because, (1) very few people remember what you have predicted, and (2) the other thing is you can always say: factors which intervened in between the time that you predicted and the event occurred, prevented your prediction from coming true. There is a great deal of truth to this, i.e. predictions really have to be projections of established trends. If there is a new discovery or new things happen that you did not predict, then all of your predictions are modified to some extent. We can say, on the basis of what we know now, unless there is an major intervention and major change, that we have the right to predict a substantial increase in numbers of multiple handicapped children, because our health services have established very clearly their ability to improve the survival rate of children at birth but have been less able to reduce the number of handicapped children who have been saved, but not completely free from handicap.

We are seeing a great population increase and there will be probably approximately the same percentage of handicapped children as there are now, but that will mean that there will be more handicapped children, because 10% of 100 million is larger than 10% of 50 million.

The handicapped person will likely face increasing difficulties in the job market, since jobs in 1980 will require much higher levels of skill and academic training. It follows from this that we need much more effective and better educational programs to improve the opportunities of that youngster to meet that higher level of challenge.

There will be an advanced technology in the number of dimensions which will provide increased capability for sensory stimulation for those who are visually or auditorially handicapped. There will be earlier identification of handicapped children and a great increase in pre-school programs for the handicapped. This is already taking place. This is an easy one to predict because we are in the business of implementing that kind of thing.

School programs will be involved with all the dimensions of health, education, social and emotional development. One may expect to find many more diversified rules being played in the educational setting to replace the current limited role of school staff, of teacher, principal and superintendent. One of the things that Head Start has taught us in education is that youngsters, particularly youngsters that have problems that come to school, do not come divided up into pieces of cognitive development, social development, health problems, nutrition problems. They are all of one piece, and it is important for the educational community to respond not only in the educational domain, but in a domain which insures that all of these necessary services reach the youngster.

We can expect that the Federal role in support of education will increase gradually in terms of financing and responsibility as the national commitment to educate all handicapped children becomes more clearly defined. We should expect major research developments, perhaps in the genetic area, that will help reduce or eliminate certain easily identified negative genetic factors, and produce conditions such as mental retardation and deafness, but most of these conditions are extremely rare, and that while they will be helpful in certain specific kinds of conditions, a major break-through in terms of a major immunization of the incidence of handicapping conditions across the board does not seem to be on the horizon.

The influence of the family, if things continue as they are, may have a relatively declining role, and the society will increasingly assume responsibility for care, treatment and education of citizens who are in trouble. One should expect to find a greater proportion of organizations present in the total educational system. Diagnostic and evaluation centers, research and development centers, demonstration programs, etc., to replace the kind of image that you can recall when you were going to school. The increasing network of communications will link more closely the various parts of the country and permit rapid interchange of technical and professional skills, and so the gap between the best of programs and worst of programs should be meaningfully reduced.

The continued development of automation increases the likelihood of computer-assisted instruction and automated self-instructional devices. These devices will play a support role in a number of educational programs, and an added implication to the advances of technological -- technology, is that more and more people will find a satisfying career in developing the instructional materials that are placed on these machines, since we already know that the soft ware, what the program is that goes on in that machine, is a little harder to produce than the hardware, which is the equipment itself. A much greater flexibility in school architecture for the future will provide for a variety of specialized services, and instructional settings, and one of the things that we look forward to is a reduction in the gap between dimensions of health and related services, and the field of education. We are trying in our own ways to reduce that gap, and one of the things we are talking about is the monumental prenatal study that has been supported in the health services, to look at the 50,000 pregnant women.

One of the research projects that we are supporting out of our educational services, is a follow-up study of following these youngsters into the schools, and to see what kinds of problems they are having terms of adjusting to the school program, and then relating that back to the conditions surrounding the birth of that youngster.

The Bureau of Education for the Handicapped is a tangible reminder of the changing status in the area of education of the handicapped. It was established two years ago in the Office of Education. A Bureau is the highest operating level in the Office of Education. There are six operating Bureaus, and The Bureau of the Handicapped is one of those six. In addition, there is the Bureau of Elementary and Secondary Education, Bureau of Research, Bureau of Adult Vocational Library Programs, etc. Handicapped in this regard and in Federal legislation refers to those who are mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, crippled, seriously emotionally disturbed, and other health impaired children, who by reason thereof, require special education, and the end goal of special education, as I understand it, is to provide those kinds of services which will allow youngsters who are handicapped to lead the maximum normal life and existence that is possible, and sometimes these services are delivered in a separate situation as soon as the youngster is capable of moving back into the regular stream with the help of maybe just supportive services.

For many years, there were only a handful of employees in the Office of Education concerned about education for the handicapped. Today, we have over 100 employees in our Bureau and we operate with an annual budget of more than one hundred million dollars. That may sound like a lot of money to you, but I want to tell you that, in terms of State and local educational agencies, as far as we can discover, they are putting another nine hundred million dollars into programs of education for the handicapped, making this a total program of over one billion dollars and we have not listed what the private sectors contributions are in this area, which are substantial.

The Bureau has three operating divisions, and one of the great advantages in having a Bureau organization, is that you can tie together the essential thrust for change. You can tie together research which tells you new ideas which you need to have, which you can service, which tells you how to deliver what your existing knowledge has, and training, which has to be modified if you are going to implement the new knowledge and the new skills that you have. If you do not put these three pieces together, your knowledge is going to lie loose and unimplemented.

The dimension of research supports investigators and organizations in research and related areas, designed to produce the maximum education benefit for the handicapped, so we are supporting over one hundred investigators, a major research and demonstration center at Teacher's College, Columbia, and we have a network of 14 instructional materials centers. This is perhaps one of the most interesting things we are doing in our research division and that is to get the newest in materials and media into the hands of the classroom teacher in the maximum possible time. The discovery of a new idea, the discovery of a new teaching method is one thing, but the dissemination of this over 20,000 school districts is one of the greatest challenges of the educational establishment which it faces.

There are always good teachers somewhere that know how to do things effectively. How do you get that knowledge and how do you get those skills you have to ask yourself this kind of question, where is that youngster at 9:15 in the morning? Where is he going to be at 10:30 in the morning, and what is he doing and who is he doing it with? The answer almost always comes back, he is with a teacher who is attempting to instruct him, to help him learn.

So, we think that one of the most constructive things that we can do from the Federal level is to provide the resources to colleges, Universities, and State Departments of Education, so that they can prepare effective teachers that can deliver the services and skills to these youngsters.

The Division of Education Services covers a wide variety of distribution of resources, but there are about thirty million dollars that go out on a state-aid basis, to help each State Department of Education improve its programs within the state, for the handicapped, another thirty million dollars is being given to agencies which run state supported institutions for the handicapped within the states to improve their educational programs and resources. We are just beginning to develop a program of centers for deaf-blind children. As you know, the rubella epidemic of '64, in that particular area, has produced a large number of youngsters with special needs in this area. They are not needs that are likely to be taken care of by the local community nor by the states in many cases, and so from the Federal level we are hoping to establish seven or eight centers around the country which will provide comprehensive educational services for youngsters who have these problems. They have regional resource centers, which will provide some supportive help for teachers, either in the rural areas, or, perhaps, even in the urban city areas. We have some money that has been set aside by the Congress in the area of vocational education, so that 10% of the disseminated? These centers are an attempt to do this, and, in some parts of the country, in the rural areas, they have purchased mobile vans, which they will fill up with materials and books and new devices that have come out, and they put them in these vans and the person drives them around the countryside, sometimes in a two or three state region, much as the old peddler has his new materials and he goes out in his wagon and he visits these communities that are out in the boondocks. But the important thing is that which we are at least seeking, we have not found the answer to this problem. It is a very difficult problem, but we are seeking the method of effective delivery of services, so that we can cut the gap between the discovery of knowledge and the implementation of knowledge at the local educational level.

In the areas of division of training programs, we provide support to institutions of higher learning, to state education agencies, so that the programs for the preparation of special education personnel can be supported or expanded. This year we are spending 29.7 million dollars to 261 public and private and nonprofit institutions of higher education. This involves all the State educational agencies as well, as well as the District of Columbia, Puerto Rico and the Virgin Islands, and this provides support for graduate students, for undergraduate students, and support for the University as well, and to help them develop their programs to train specialists to work in this area of education. One of the things that we feel very strongly about is that we want to form a more effective alliance with the medical and other services, because our break-throughs in education frankly have not come yet. We think they are ahead of us. Some of the break-throughs in medicine have already occurred. But the youngster who is handicapped, and money, in a major new Vocational Education Act is going to be spent on handicapped children and in providing vocational education for the handicapped to improve the bridge between the school and the world of work. We have a new program of early education model and demonstration centers for handicapped children to provide at the earliest possible age level, the model for which we can follow and the local communities can provide more effective services, at the early time when we know that the intervention is most effective.

I have tried to communicate a feeling here and that is the feeling that there is a great deal of action, and there is a great deal of movement that is taking place. It is true, and one of the things that it is always nice to do is to come to a group of people who represent the private sector, who represent those people who must provide us with our support from the outside, who must also join hands with us in the many kinds of different activities that we have in common. I once heard someone refer to the real crisis of our society by saying, we really have to make up our minds as to whether we are a people society or a thing society. And, coming before this group, helps me to feel that, at least, we are leaning more and more in the direction of a people society.

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RESEARCH: NEW DIRECTIONS FOR THE NEXT 20 YEARS

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UNITED CEREBRAL PALSY ASSOCIATIONS, INC. ANNUAL CONFERENCE

STATLER HILTON HOTEL, WASHINGTON, D.C., MARCH 7, 1969

I note that the title that has been put in the program is "Research: New Directions for the Next 20 Years". You will forgive me if I interpret this as an invitation to say something about the programs which the scientific advisors of the UCP Foundation are now beginning to put into effect, without specific mention of 20 years. The 20 years I will interpret as looking backwards as well as forwards.

I well remember the beginning of the United Cerebral Palsy Association. The handful of devoted lay people that decided that they had to do something more for the child with cerebral palsy than was being done, and they decided also that this whole group of disorders which may be summarized under the one term, cerebral palsy, should be done away with, should be prevented, so that misery of this kind would not be continued to be visited upon child after child, family after family. I was deeply impressed by this small group of lay people. I well remember the first visit of Mrs. Goldenson, who had a degree of determination that could not be denied by anyone who was interested in his fellow man, particularly children.

The organization, perhaps represented here tonight by some of the pioneers and by so many of you, who were here at the beginning or came in some time afterward, not really realize how much effect they have had on the care of the child with cerebral palsy. There were very few people in the country who were expert and had the facilities. I am delighted that I have the privilege of being here tonight to see Dr. Perlstein honored so fittingly for his enormous contributions, as Dr. Berenberg pointed out so beautifully and clearly. But there were very few at that time.

In hospitals where cerebral palsy children were cared for, did the best they could with the staff they had available, with the facilities and resources, but what has happened in these 20 years because of the deep concern of a group of human beings for their fellow human beings has been extraordinary. The history of medicine since World War II, has been altered repeatedly and markedly by the deep interest of lay people in the work of doctors and scientists. The whole growth of this greatest medical and scientific organization in the world, the National Institute of Health, has come since the end of World War II, because of the deep interest of lay people and doctors and scientists throughout the country in making much more rapid progress than had ever been possible before, because of lack of resources, lack of facilities, and lack of trained manpower, and these are the great accomplishments of the National Institute of Health, and so our particular pleasure, Dr. Robert Berliner, and your colleagues from the National Institute of Health who were here tonight, in speaking of this enormous contribution that has been made in and through the National Instiutes of Health, with the aid of private organizations such as this. Time after time, since the end of World War II, emphasis has been placed earlier and much more effectively on specific areas of disease because of the interest of the country as a whole. Our problem is an enormous one, in getting the interest of the Congress, the administration, the country, to keep up the wonderful support that grew year by year from 1946 through 47 on until a few years ago. We have been on a plateau in research support for the last five years, and we may even regress this year in the support from the National Institutes of Health, because of costs of living, the supplies and salaries are going up, and the amount of money has not increased. In a number of areas, it has actually decreased. One of the greatest contributions of the National Institutes of Health, the research performed there, and research supported through the National Institutes of Health all over the country and previously in other parts of the world, is the support of basic research. So, it should be no surprise to you that this organization may I say this for my friends and colleagues from the National Institutes of Health, that this organization from its inception decided that they would support research of importance in the general field of damage to the central nervous system and the consequences thereof, and the people here in this United Cerebral Palsy Association, so deeply concerned with their own children and the children of their friends, and children of families throughout the country with cerebral palsy. We are deeply concerned with the lack of fine care facilities for them, willingly follow the advice of our research advisory board and invested for the first 20 years most of our monies in basic research, and this has been one of the sources of support for those who worked in the field of the central nervous system.

Now, what a private organization can do, no matter how great, cannot compare with the resources which the President and the Congress have at their disposition, and I suggest to you that in this period of time when the National Institutes of Health have programs which are actually in jeopardy because of the lack of security of continuing financial support, there are two things that we can do. First, as a private organization, let us receive from pivate individuals much more money for research, and research can be supported at all levels from basic research to clinical application, clinical investigation. And second, let us tell our representatives in the

Congress who work for us, the people, that we are deeply concerned about this situation, and that we must not today after training hundreds and hundreds of young scientists, tell them that there is no more support for their research, or that they should go into other fields. When we are told that, in one city in the country, 35% of research laboratories built after great efforts on the part of private individuals, with the aid of the National Institutes of Health, are actually empty because there is not sufficient research support, we have some idea of the magnitude of the concern which all of us here have.

The Congress is responsive to two types of appeal. First, they must understand the magnitude of the problem of disease, and how important it is to find solutions for problems which can be solved if only there is sufficient research supported, a sufficient number of scientists given the liberty, the freedom to work in the fields of their choice. And second, the Congress is responsive to accomplishment and we have heard tonight the work of two distinguished young scientists working in the National Institutes of Health, whose work should be an inspiration to the Congress as it is to all of us here tonight.

And now, what of our plans for future research? I want to say at once, that the kind remarks which Mr. Goldenson made and I appreciate, belong to the scientists who worked on the Research Advisory Committee and to the many clinicians who have increased in number and in interest in the last 20 years in this important field. It should be addressed to the Fellows, who were supported by the United Cerebral Palsy Association, and trained in clinical cerebral palsy, and in basic fields of research. My colleague, Dr. William Berenberg, who succeeded me as Chairman of the Research and Professional Committees; Dr. Brewster S. Miller, the hard-working, effective Administrator, to these men and to their colleagues belong the kind words which we have heard.

A small group now hold a steering committee of the Research and Educational Foundation of the United Cerebral Palsy Association, have been working on research programs of the future, and this group includes in addition to Dr. Berenberg and the Associations, Dr. Brewster S. Miller, Dr. Charles F. McKhann, and Dr. H. Houston Merritt, the celebrated neurologist of Columbia University Medical School, who has carried out so much work in neurological disorders. The decision was made that, at this period of time in our history, 20 years after the beginning, the work of people in many fields, in many institutions throughout the world has reached the point where we could identify certain specialized problems, specific problems, which deserve much more research activity and which might yield great results in the prevention of cerebral palsy. We understand that clinical investigation must go on to improve the lot of cerebral palsied children, and we are deeply concerned that there is not sufficient clinical investigation going on because of lack of support in this important field.

If I address my remarks now, for the next few minutes, to the prevention of cerebral palsy, you will understand that I have chosen this not because I am less interested in clinical investigation. I take the point of view, as I have throughout my professional career, that there are no incurable diseases. There are simply diseases concerning which we know too little. I have a deep and abiding faith in what the basic scientists, the clinical investigator can do to do away with diseases, to render the word "incurable" meaningless, and I say this with complete objectivity, without any reference to what I would call a "fickle calendar." One never knows when the answer will be found when research is started, and there must be no false promises. But there are four large areas which this Steering Committee particularly has defined.

The field of prematurity, we put as number one because of the known association of cerebral palsy in babies born prematurely, and this is a tremendous field for research, which takes in many different disciplines, many fields of medicine.

The second is the whole field concerned with obstetrics, The beginning, pre-conception, through the whole period of pregnancy, and the action here of toxic materials, or of viruses from the mother, which might affect the fetus and so the baby. The whole field of obstetrics concerned with the act of birth, and the resuscitation, the period immediately after birth, the perinatal field. And enormous increase in knowledge has been offered by scientists and doctors working in this field for the last 20 years. But there are still very many pressing, unsolved, problems, which will certainly be clarified much more than they are now and finally totally clarified by greater concentration on research activity. There is the field which we have had represented tonight by Dr. Meyer and Dr. Parkman, the field of viruses which affect the brain. Dr. Meyer, in his very fine remarks, mentioned a number of virus diseases and the number of vaccines which, as he pointed out, have come from activity in research in this country, and we are not surprised at that because of the nature of the research effort in the last 25 years here. We intend to pinpoint other viruses which affect the nervous system, and see if vaccines cannot be produced one by one, hopefully. All at once would be the ideal by maybe different research workers concentrating at one time and see how many of these can be prevented.

Then, finally, there is the fourth group, concerned with the incompatibilities of blood groups, and one of the best examples is the RH factor which all of you have heard so much about and here is an example of a disorder which is responsible for cerebral palsy of severe degree and large numbers, which was understood by research activity and which can be eliminated today by recent research in this important field. So, here we have picked out four large areas and there are so many others that we intend to follow through on, which deserve very special attention. We are going to alter our procedures in order to pay special attention to these important areas. Whatever we do in research supported by this organization, will, of course, be in cooperation with the far greater activities made possible by the National Institute of Neurological Disease and Stroke and with other associations which are engaged in similar research support. What we intend to do is to use much more of the Task Force principle if a problem can be defined, to seek out with the aid of our colleagues and friends of the NIH, the people and institutions where such research can be expanded: The people, because all research depends on people; the research institution because even the best of men cannot work in an environment which is not favorable for research.

We hope that there will be much more in the way of collaboration between and among research workers and institutions, realizing always that in any collaborative effort, there must be freedom for the individual, if we are, truly, to have great research progress and if we are to continue to have new ideas brought into research endeavors.

What has this to do with the next twenty years? I want to make clear that cerebral palsy is a series of disorders caused by many different agents or circumstances which are unrelated to one another. In this matter, we may compare cerebral palsy with cancer, which is a name for perhaps 200 different and very likely unrelated disorders, which may have one basic common denominator and basic research will discover it. Until then, we must find and treat many different causes of cancer and many different kinds of cancer as though they were many different diseases. That is our problem, here, in cerebral palsy.

I well recall the beginning of the National Institute of Neurology and Blindness, as it was called then, and Mr. Goldenson was one of the original Council members when that institution was formed, and one of the great problems was blindness, which occurred much more commonly to an alarming degree in small prematurely born babies. The name was retrolental fibrosplasia. There were many different observations made by different institutions and obstetricians and pediatricians, and there was one basic question on which they differed. What did the larger amount of oxygen we gave prematurely born babies have to do with this? Did they need more oxygen, or were they getting too much oxygen? At that time, Dr. Frederick Stone, the Director of the National Institute of General Medical Sciences, working administratively, created an environment which made it possible for a number of institutions to work together, and in an incredibly short period of time, this very frightening disorder, this blindness, which was increasing markedly all over the country, was found to be caused by the administration of too much oxygen, in an attempt to prevent other damage to the prematurely born baby. This is a beautiful example of cooperative research with freedom for investigators who agree on what they want to do. We hope that we are going to see a great deal more of it in our program, now that goals are so clearly spelled out, and the problems which can be tackled with the manpower we have available, with the institutions available, and above all, with the knowledge which has come from basic research as well as clinical investigation from scientists and doctors all over the world.

While this is going on, I hope that there will be a great increase, stimulated at the National Institutes of Health, stimulated by this association in common with others, on clinical investigation, directed at the alleviation of as many of the problems faced by the cerebral palsied individual who has already been damaged. It is my conviction that with continued emphasis on clinical investigation, too, with the great increase in clinical investigation, that much progress can be made for the welfare, the well being, and the happiness of those who are already cerebral palsied.

I want to thank you for this opportunity to be here on this very happy occasion. The honors which have been awarded, and to the time when I can look back on twenty years of knowing people who have done so much for their fellow man, as you officers, you founders and all of you, who are here tonight!

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A BLUEPRINT FOR PREVENTION

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STATLER HILTON HOTEL, WASHINGTON, D.C. MARCH 8, 1969

One of the things that may have bothered some people last night and has bothered others who are concerned about cerebral palsy is the direction in which we are talking and heading, in terms of this massive importance that we are placing on prevention. It is fair to point out, at the beginning, that this does not mean abandonment in any sense of the word of concern about basic science as it relates to cerebral palsy. It does not mean abandonment of the child in terms of his needs, in terms of clinical research and improving his treatment or evaluating the modalities of treatment. All of these things are worthy not only of continuing concern, but of more support and more concern than they have been given, so that because we seem to be heading in a new direction, by all means does not suggest that we no longer are concerned with the other areas of importance.

We have been increasingly concerned about the problem of prematurity as it relates to cerebral palsy. All of us would agree that, certainly in this country, at least, if not throughout the world today, prematurity stands out as, perhaps, being our number one enemy in terms of statistical correlation with cerebral palsy. Almost all of the cerebral palsy clinics today will tell you that, at least 30%, if not as high as 50% of their new patients are individuals who were born prematurely and it seems pretty clear that the incidence of cerebral palsy remains roughly at about 1 per thousand live birth. But, if one looks not at the total population in newborns, but at those children who were born weighing four pounds or less, then, the incidence of cerebral palsy goes up from one per thousand to eighty per thousand, which is a rather staggering figure. It seems clear that particularly the spastic diplegic variety of cerebral palsy, which is the type ordinarily associated with prematurity, that for every two weeks that the fetus remains inside its mother in utero, particularly between the 30th and 40th week of pregnancy, that for every two weeks that he remains there, the chances of this developing cerebral palsy of this type is reduced by 10% which is a rather staggering figure and certainly represents a challenge to all of us.

We have seen a rather shocking incidence increase in the incidence of prematurity throughout this country. Boston figures show roughly, for the Boston Lying-In Hospital over this twenty year period, that we depict here an incidence of prematurity which has gone from roughly about 5 1/2 per cent to close to 9 per cent and these figures parallel what is happening across the country. There will be discussion in terms of a host of social factors which enter into this in the economic factors as well as the medical factors but these are the further definition and, hopefully, some degree of prevention. We have contributed to this in some ways by some of the major advances that have been made in the care of mothers. Certainly, we have contributed to this to a certain extent by the increasing success of fertility clinics so that they have a live-born baby and, now, with this increasing and expanding success are able to go with their pregnancy to the point where they produce a premature baby. This is not to be taken as to suggest that this is a step backward. I am sure it is a step forward. It is a price that we should be willing to pay, but one that I think we still must improve.

We are all rather proud of great strides that we are making in terms of respiratory distresses of newborns and lack of oxygen and our ability to measure things. This slide, which shows how sophisticated we thought we were in terms of having a newborn, so that we could measure his temperature and pulse and respiration and blood pressure and this electrocardiogram. When we think of the group, who are up in their lunar module today, and the amount of sophistication that has gone into monitoring what is happening to them in outer space compared to the really poor job that we are still doing in terms of trying to evaluate children with this type of difficulty.

The spector of the RH factor which was so overwhelming in pediatrics just 20 years ago is one that we should discuss with a certain amount of pride in terms of how far we have gone. About 20 years ago, infants that were involved with this problem at the time of birth had as an aftermath a type of cerebral palsy erythroblastosis fetalis. If one looked at the total cerebral palsy population in clinics throughout the country these made up about one-third of all the CPs of that era and we, within this short medical lifetime, really enjoyed the spectacle of seeing this condition defined, its cause understood, have witnessed an excellent way of treating it and preventing brain damage and, now, I think, are faced with the delightful possibility of success in preventing this altogether in the future.

The new immunoglobulin which really represents the same as a vaccine attempt of preventing this difficulty, so that we no longer have to use exchange transfusion, make the figures clear that the success rate of having no difficulty out of 72 instances in which women were treated this way versus the control group still having trouble with thirteen out of 64. The day is close at hand, where globulin is going to be available to all of those women in an effort to prevent it.

We still have been faced with a considerable amount of concern with jaundice, particularly, as we see it among the premature and in blood grouping incompatibilities other than the RH factor. Incompatibilities of the A-O-B group, which still plague us. Unfortunately, we have let our concern about jaundice down since we have conquered the RH problems. We brought it down in too many nurseries, so that people are not really that sensitive to early recognition. We still are in great need of an adequate means of monitoring newborns so that we could pick it up early. Particularly, since the use of ultraviolet light in the chamber, such as this, or exposure to daylight, or modifications of this, seems, or is very nearly, a very effective and simple way of dealing with this type of jaundice in the premature. I shall be very surprised if we do not see widespread use within the next year or two of this type of equipment, which,I am hopeful, will in great measure replace the need for exchange transfusion altogether.

Dr. Nadler is going to talk at some length about the problem of diagnosing disease in-utero. I hold forth the hope that, with improvement in genetic counseling, we will be able to prevent many difficulties. The problem of interruption of pregnancy is one that is going to give us increasing need for thought. The day is close at hand when medical or surgical therapy will be available to all. Before long we are going to be witnessing surgical intervention with correction of certain defects and, perhaps, the return of the fetus successfully back into the uterus to complete its journey to full term.

I am most concerned about the problem of head injuries and, particularly, as it relates to motor vehicle and automobile accidents. In the United States or throughout the world actually, there will be a tremendous number of individuals, who will be killed this year, which is a sad thing, but we are faced increasingly in the cerebral palsy clinic with individuals who have had head injuries resulting in cerebral palsy. Some clinics have reported that this incidence of this is a cause for cerebral palsy. It has gone up as high as 10% of their clinic population. If one looks at death rates from all accidents in the United States, and, if you take out the motor vehicle accidents, it is even sharper. But, if you look at the automobile accidents alone and deaths resulting from them, we have had this appalling and absolutely striking increase. From our point of view, or in terms of head injuries, if one looks at the body zones, which are at risk in automobile accidents, 81% of these individuals will have some part of head injury and certainly inexperience in driving or temperamental difficulties among the drivers, sick individuals behind a wheel, alcohol, high speed, highways and automobiles which go much too fast for those and make these really low safety highways, the failure to use seatbelts, the failure to improve safety equipment in automboiles, all of these are matters of great concern to us.

This is even more vivid among those people who are addicted to using motorcycles. In the California study, in the college population, the significant injury rate, particularly among those individuals, who use motorcycles rather than automobiles, is 18 times higher, particularly for head injuries.

We have been encountering an increasing and striking number of individuals who had brain difficulties as a late complication to previous "successful" surgery for heart involvement. The great success of the cardiac surgeons today in prolonging life and carrying individuals through for a great number of years has increased the number of individuals, whom we have seen with various types of brain damage, which are complications of this type of this type of prolongation. This is not to suggest that we need less surgery. Clearly our objective needs to be less surgery, but better surgery, and better methods of preventing this. So, here again, we see a situation where success in one field increases the pool of disability in another and it is one of the prices that medicine is familiar with and we are accustomed to paying.

The caption at the bottom of this slide says, "Good girl, your weight is down by seven pounds." For too many years, prenatal care in this country has centered too much around blood pressure, weight, and an occasional urine analysis, and has about ended there. In many areas in obstetrics and clearly our need to improve prenatal care before a host of factors which must be considered here is an area which needs to be improved.

There will be some discussion this morning about high risk pregnancies, wherein a city here in Washington, particularly where around the conference tables up on the hill, the term high-risk center has become a very popular one. If we could afford the cost in dollars, and provide the manpower, then, we could, probably, make a major impression, particularly on the socioeconomic factors which relate to high risk in pregnancy. Even if we are successful in this regard, there still remain a host of important obstetrical factors and pediatric problems which will not be solved in this way and which can be solved only by providing good care to this entire group. Unfortunately, we are at a stage in terms of planning for some of these high risk centers, where too often we are talking about an undefined population, which is being screened for undefined conditions by people who are really untrained to detect the conditions.

Now, the great Osler once said that "the desire to take medicine is, perhaps, the greatest feature which distinguishes man from animal." A recent study in Texas showed that during the first timester of pregnancy women throughout the state took an average of 3.1 drugs during their first trimester which is just an overwhelming thing. Here is an example of the great tragedy of thalidomide which is so well known to all of you. I hasten to add that there probably are a number of other drugs which have been defined as capable of doing comparable things in producing brain damage and probably a host of other drugs, which have really not been established as yet but still give us concern. It was Olive Wendell Holmes,in his own cryptic way, who once said that if the whole materia medica, all the drugs we have, could be sunk to the bottom of the sea, it would be all the "better for mankind and the worse for the fishes." At times, this is certainly true.

We have had increasing concern in terms of drugs with the effect of what things like LSD will do to chromosomes. The arrows indicate breaks that are produced by LSD, not only in their own chromosomal structure, but also in that of the fetus if a woman is pregnant. The significance of this has not been established as to whether this really results in any significant damage to the baby and this or any subsequent generation, but it is a matter of concern. You cannot help but philosophize and think that some of the long haired, hippy, users of LSD, who profess great concern about love for mankind and what is going to happen to our future generations are really probably no more sophisticated, than the young philosopher depicted here because certainly many of them seem to be headed in that direction.

Here is a century old painting by Hardy, which depicts children at play, playing doctor which seems to be a favorite game. Some of us never outgrew it. But watching them here, you can notice that two little rascals are off in the corner, trying to get into something in the cupboard and, probably, it is some type of medication that was meant for the grandmother, who is standing in the doorway. But we continue to see the significant number of children, who, after accidental ingestion with the variety of poisons, have resultant brain damage. Here is a situation which is clearly preventable and simply should be prevented in the average household.

This painting by Gozoli, back many years ago, shows saints and novices resuscitating the child here. It is a recurring scene in religious paintings, this business of resuscitation. He has been very successful because we can see she is now standing up and walking away, but we are faced with modern medicine at the moment with a group of individuals who a decade ago would die and who now are being kept alive because of great advances that are being made in resuscitation. The fear of going into an operating room and losing the patient because of anaesthesia has almost become a matter of the past. But the sudden arrest of respiration and of heart action and the resuscitation on a number of occasions are less than totally successful and we see an increasing number of individuals who suffer relatively permanent brain damage and cerebral palsy as a result of this type of success.

One of the problems that faces us is this kaleidoscope, you know, taking the great step forward with things like rubella vaccine and slipping back with head injuries and poisonings and all these other things that we have been talking about, and we often are concerned about the total problem and feel rather like the Red Queen in Alice, during her rather frantic race in Wonderland, and can only say that it really takes all the running you can do if you really want to stay in the same place. Medical knowledge is increasing at such rates that our speed increases and we will stay ahead of the game.

We must not be content with success or unduly disturbed by failure and the task of preventing cerebral palsy altogether certainly appears overwhelming but we shall not display reluctance to attack it, we cannot permit continuation of some of the catastrophies in the past anymore than we should accept, as Dr. Farber said last night, those of the present as being "incurable." Only our doubts and our own limited imagination will prevent the realization of our objective.

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CONTROL OF INFECTIONS CONTRIBUTING TO BRAIN DYSFUNCTION

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PRESENTED AT UNITED CEREBRAL PALSY ASSOCIATIONS, INC. ANNUAL CONFERENCE
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I have had the privilege over the past few years of participating in one of the exciting success stories in medicine in this decade. An award was given last evening to Dr. Parkman and Dr. Meyer for their most significant contributions to this success story. What I would like to do today, because we have been talking about these virus diseases in abstraction, is to try to bring you a sense of what this is really all about in terms of mothers and their children. There are a number of virus diseases that contribute directly to cerebral dysfunction. Some of them are well known to you and are becoming diseases of historic importance, such as poliomyelitis, measles, etc. Measles, prior to the availability of virus vaccines, was in essence a universal disease of childhood, roughly 99% of all adults had measles some time during childhood. If there were between 3 and 4 million children born each year in this country, and there have been for a number of years, and all of these children, for practical purposes, before the age of twenty developed measles, then that means that there are roughly 3 to 4 million cases of measles on the average each year. It is quite well known that out of every roughly 800 children who develop measles, at least one will develop measles encephalitis.

This is a condition that is measles encephalitis severe enough for doctors to recognize it. We have no idea how many children developed measles encephalitis. There was such a minor extent clinically that it was unrecognized, but the consequences of measles encephalitis are frequently quite severe. There is only a minority of children, roughly 20% perhaps, who die with measles encephalitis. The rest either go on to complete recovery, or they go on to degrees of cerebral dysfunction that may be easily detected or may be quite difficult to detect. Measles is becoming a disease of historic interest. Measles vaccine has been licensed less than five years. Over 25,000,000 doses of measles vaccine have been given in this country and the amount of measles in this country has been decreased over 90%. So, you can see that this will make an enormous impact on brain dysfunction caused by this viral illness.

There are some other viral diseases for which we do not have such a success story. We do not even know what their impact is when it comes to cerebral dysfunction. Such conditions as cytomegalic virus infection which means an infection occurring in the pregnant woman with no signs of symptoms, yet producing a disease pattern similar to that for rubella. A number of encephalitis viruses frequently associated with mosquitos, we do not know the impact of these diseases on brain dysfunction in this country, but they may be considerable.

If we can understand what has gone on in the problem of rubella since 1961, it may serve as a model in terms of our thinking about other virus and infectious diseases, non-viral as causes of cerebral dysfunction.

This is an eleven-month old boy who has rubella and my guess is that, in the back of the room, you cannot even see his mild, and what has to be called nondescript, rash. There is nothing about rubella, or the rubella rash which is diagnostic and no physician can make an unequivocal diagnosis of this condition on the basis of how the patient looks or feels. Important things to note are the fact that he does have a little rash. He frequently has swollen glands behind the ears. He is not sick. Rubella is generally a mild illness. Of great importance is the fact that one can have rubella with none of these signs and symptoms. One can have rubella infection and be clinically well.

This is the natural history of rubella with regard to the pattern of virus excretion and the antibody responses and this is of importance. Down below is a time scale, days before rash and days after rash and then months and years. Virus is first apparent in pharynx, in the throat of a person with rubella as early as a week before the onset of rash and persists for as long as two weeks after the onset of rash. Now, several important implications. First, the patient with rubella is highly contagious long before he even knows he is sick and he remains contagious for a reasonable period of time. This rules out quarantine as a method of control of this disease. Also, you will notice that virus is present in the blood. This line labelled viremia which merely means virus in the blood for as early as a week before the rash. Now this is of great importance because if this patient happens to be pregnant it means that virus is being disseminated through the bloodstream and is capable of invading the placenta well before the woman knows that she is even sick. Note also complex lines that follow the same general pattern and relate to antibodies against German measles. Before German measles there is no antibody. If a pregnant woman is exposed to German measles and a blood specimen is drawn at the time of exposure or shortly thereafter, she has no detectable antibody that means that woman is at risk from infection. By the same token if a blood specimen is drawn and she is found to have detectable level of these antibodies in her blood, she can be reassured that she is not at risk of developing rubella disease again. Now, the whole hope in vaccination is that you start with a population which has no antibodies, ou give them the vaccine and then, just as in the natural infection, the vaccine nfection. When you vaccinate with a live virus, you are giving an infection only t is a mild, weakened infection. The patient will start out with no antibody and ill develop antibody that will reach a high level and, then, will persist for months r years and, hopefully, with protection against reinfection for life. The mmunization program is to try to duplicate this sequence of events. The other mportant factor, since roughly 9 out of 10 women of childbearing age are immune to erman measles, is being able to tell a woman when she is exposed that she does ave antibody and that she is not at risk of infection or that she does not have ntibody and, therefore, must be followed very carefully. She has to be followed ith blood tests because one can develop this illness with all its consequences ithout any signs or symptoms.

Here is an eleven month old infant who developed rubella in utero at six eeks of age and at eleven months she weighs about nine pounds. She has a tiny head, big open interior fontennal, the soft spot. She has cataracts in both eyes, she is eaf, she has no teeth when she should have half a dozen. She has heart disease, a uge spleen, a huge liver. She makes abnormal antibodies in her blood and is still eavily infected by rubella virus. She can not lift her head at this point. This llustrates the sharp contrast between rubella when it occurs postnatally, in other ords in children and young adults and when it occurs in the uterus.

If we look at a similar kind of graph, only this is called the natural history f congenital rubella, the pattern of virus excretion and antibody response. ou notice that the rubella virus infection begins early in pregnancy. This is birth s a point of orientation. The infection persists in the fetus not just for several eeks as it will in the mother, but throughout pregnancy and for months thereafter, ccasionally for more than a year. The fetus does produce antibodies against this nfection, these lines here, and, of course, the mother produces a good deal of antibodies, too. But, being able to produce the antibody does not protect this fetus against infection, nor does it stop the infection during the early months of life. While the child remains infected after birth, this child is a source of contagion to those who may handle the child and it was observed in 1964 that secondary outbreaks of rubella occur which are caused by these children still shedding virus.

Now, we know a good deal that viral diagnostic techniques have been developed about the sequence of events which lead to these birth defects. The virus appears in the mother's blood during the course of the illness. Next, the placenta becomes infected. Then, after placental infection, virus goes through the umbilical vessels and is spread to virtually every organ in the fetus and one can isolate a rubella virus from virtually every organ of the fetus. It is not, therefore, surprising that this virus infection can cause birth defects in virtually every organ.

In 1964 there were suddenly births of many babies who looked just like this one in hospitals all over the country. This child has neonatal thrombocytopenic purpura, which means that the baby has purpura which is bleeding into the skin, these little purple spots caused by absence, or very little, platelet counts in the blood. We now know that this is a common manifestation of rubella acquired in utero. This child is quite jaundiced. Rubella also causes hepatitis. Fortunately, in those children who survive this, purpura goes away during the first months of life and so does jaundice. But it is frequently associated with many other birth defects which do not go away.

One of the major problems of these children is a failure of uterine growth. They are quite small. Most of the weights are below the tenth percentile. We now know that one of the ways in which rubella causes damage to these organs is by decreasing the rate of cell growth. Instead of cells dividing normally and with normal frequency, the rubella virus stops this cell division and this is a source of much of the rubella birth defect problem.

Among a group of infants, who looked like the one I showed you, not only did they have this neonatal purpura,but two-thirds had heart disease and almost one-half eye lesions, cataracts or glaucoma, as well as a whole host of other problems.

These are x-rays of the long bones of the leg of another three-day old infant showing that rubella causes defects and these defects are due to disordered bone growth in the bones of the child with congenital rubella. And, these are x-rays of the same child two months later. Fortunately, this clears up. There are a whole host of conditions that do not clear up.

These are cataracts, a typical rubella cataract that caused Dr. Gregg to turn his attention to rubella in pregnancy. They do not go away. If they are not handled properly, they result in blindness. Surgery for these is not so simple as surgery for adult cataracts.

This is a condition which is not quite so obvious. This is the fundus or the retina of the eye. You can find this by taking a special lighted instrument and looking into the pupil. You see all these little black specks and, then, these little white, these lighter specks. This is rubella retinapathophy, retinal changes which are not of a great deal of importance to the child, but are now known to be quite helpful in making the diagnosis of congenital rubella. If you can tell a parent that the child's problems are related to rubella, at least you can reassure the parent that, in subsequent pregnancies, they will have no risk of recurrance of these problems.

Now, this is glaucoma, which is another condition caused by rubella. This, also, is amenable to surgical treatment.

This is a photograph of the same child's eyes five months later and you notice the heavy clouding is totally gone here and almost gone here. This is one success with about eleven failures. This is a procedure that should be done by a small number of surgeons who are familiar with this condition, and should be left alone by all the rest.

This is a child who illustrates an important point. Much attention was focused on this child's obvious cataract and the fact that the child did not hear. The child was unmanageable. What was unrecognized was the fact that this other eye, which looks normal, was quite nearsighted. When this child was given a pair of glasses, he suddenly discovered the world that was missing before because of the deafness and the visual problems associated with these two lesions. It illustrates an important point in dealing with children with birth defects of any kind. We often overlook that which is important, in this case the nearsightedness, because we focus our attention on the obvious.

We have evidence that in interepidemic years we have as many as 1 in 10,000 pregnancies which are complicated by rubella in utero. But, in epidemic years, such as 1964, as many as 1 out of every 100 pregnancies may result in rubella associated birth defects. These numbers are from our own unit in New York City. They do not represent the total problem in New York. Of the first 344 infants we saw, as a consequence of one epidemic, we had 271 who had some sort of abnormality, congenital heart disease, hearing loss, cataract or glaucoma and psychomotor retardation, neurologic impairment, frequently in association with typical spastic dyplegia with typical cerebral palsy being the most common problems. At that time, we had 35 deaths in the group, our current mortality figures are around 60.

The timing of the maternal infection is most important. If you try to correlate the clinical status of the infants with the time of the maternal rubella, when rubella occured early in pregnancy, the black bars are quite long, but as you get out into the fourth month, you see more and more normal children and fewer abnormal children.

The timing, also, determines the kinds of problems the children have. The important thing is that when rubella occurs during the first two months of pregnancy, it involves all of the organs including the eyes and the heart. In the third and fourth months, it is primarily the hearing apparatus and brain which are the sources of great difficulty.

Contagion is the greatest problem during the first months of life when most of the children, 84%, are still infectious. But by the end of the first year of life, this is a minor problem. The frequency of rubella as a cause of typical cerebral palsy was recognized before 1964, with the impact that is obvious to us all at the moment. This child, in years past, might have been passed off as just another child with spastic dyplegia of cause unknown. But, with the availability of viral diagnostic tools that tell that her mother had rubella in pregnancy and of viral diagnostic tools that confirm the fact that this child has rubella acquired in utero and for months after birth, we now know that the cause of this child's problems was rubella in pregnancy.

How severe is the damage associated with rubella in pregnancy? It may be quite severe, such as what we see in this child, who at age four years, still cannot sit up or walk. These children are now in long term residential facilities for the mentally retarded.

But, what we have been working on in the past several years because of the impact of rubella is an attempt to provide facilities for mutlihandicapped children. Our special education facilities traditionally have been quite categorical. Education of normal children is difficult. Education of singly handicapped children is even harder and our techniques for special education of deaf, blind and palsied children, have frequently been less than we desired. It takes a very sturdy person to involve himself in this field because of the time and the slowness of progress that many children make. Therefore, when it comes to children, who have the kinds of defects which rubella produces, which involve multihandicapping conditions both the eyes, the ears and the brain and the heart, there has been very little effort to figure out programs which would provide the kind of service that these children need.

Since the rubella epidemic of 1964, there has been an increased interest in providing facilities for such multihandicapped children. This photograph was taken up on the top floor of Bellevue Hospital, where,in collaboration with the New York City School System, we created a small school for multihandicapped rubella children. And what we did was put a teacher of the deaf, a teacher of the blind and a teacher of the brain injured, all of whom formerly had worked in separate bureaus in separate parts of the school system. We put them in the same classroom with a medical umbrella provided by our rubella research program. What we have tried to do is provide service to children, who none of the teachers could provide adequate service for as individuals, but, by working as a team, an attempt has been made to create this kind of service.

What we hope is that by focusing on these children who have a clearly defined condition, a condition that is quite dramatic and that occurs such that there are enough of them at one time to make the need for facilities obvious that we can develop programs which will be applicable to handicapped children of all kinds and this is a start in that direction. Rubella vaccines will be produced in coming months. It has been our experience that what we must try to do is develop a two-pronged attack. One, an attack on the problems which these children present in terms of providing better educational and rehabilitational facilities and two a program of immunization which will prevent this probem.

Can we see the last slide please? One of the questions that gets asked regularly is: what is the risk of rubella in pregnancy in terms of having a child with a fetal malformation? These youngsters are twins. Joanne, who is right here, is larger than her sister and she is normal in all respects. Our laboratory tests indicated that, when her mother had rubella in pregnancy, this young lady was not infected. Her sister, who spent nine months in the same uterus, is deaf. She has congenital heart disease and is significantly smaller than her twin. Our laboratory tests confirmed the fact that her defects are caused by rubella infection acquired in utero. If one cannot predict the outcome of rubella in a single pregnancy, in a single uterus, then you can see how impossible it is to predict the outcome of rubella in any one pregnancy. What is clear, however, is that the risk of fetal malformation involving many organ systems when rubella occurs during early pregnancy is quite high. It is quite apparent that the ideal thing to do is to create an immunized population such that women will not have to live with the awful concern and decision related to what is the possibility that my rubella infection will result in significant birth defect.

Our rubella research program at New York University Medical Center has been going on almost twenty years. It is heavily funded from federal sources but our program would not have been able to develop into the multifaceted, flexible program that it is without the kind of instantaneous response which we have been able to obtain when we have needed support in critical periods from voluntary agencies such as this one. I can tell you that it is the flexibility that you create by your dollars, which allows these programs to be available when they are needed. I can only urge that you do all you can to maintain the viability of this type organization.

What about funding with regard to rubella? We were asked to calculate the costs, not in human terms, but just the costs in dollars and cents of providing adequate facilities for the children born after one epidemic, the 1964 epidemic. It comes to a staggering 2.2 billion dollars. One could run an awful lot of immunization programs, could run huge research programs for all the diseases associated with brain dysfunction on 2.2 billion dollars. So, merely on the basis of sound economy, it is obvious that we must continue to fund research on prevention of these conditions, rather than allowing intolerable conditions that the diseases produce. We have had the privilege of being involved at all levels of the rubella problem from seeing pregnant women to working with the vaccines. It has been an exciting experience for us, we think there is much yet to be done, but we are looking forward to doing it and we are looking forward to your help while we do it.

MORE EFFECTIVE USE OF TODAY'S KNOWLEDGE IN BETTER PERINATAL CARE

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I must confess I have a slight feeling that I have gotten the tough end of the panel in trying to say how we can better use today's knowledge. It is a lot easier to talk about all the problems that need to be solved and much more difficult to see what we have accomplished in the last five to ten years and how it can be applied. But I would like to tackle this by focussing on two distinct questions. One is to review very quickly the specific information that has been obtained in obstetrical research, which should be applied to the virus pregnancy and which would reduce infant mortality and morbidity and then the question of how, having defined the information available, how we achieve rapidly disseminating this information to the community at large and to practicing obstetricians and pediatricians. Now, that is a much harder question to deal with. Dr. Berenberg initially commented upon the fact that the definition of virus needs to be redefined and this is true. It is going to be a continuous educational experience. We always need to reevaluate the criteria we are using for the definition of virus pregnancy as obstetrics is provided with more and more tools for obstetrical screening. Some of the material Dr. Cooper presented and Dr. Nadler will be presenting involve specialized tools for obstetrical screening for particular problems. We are dealing with a "huge iceberg" of neurologic handicap, of which we have just begun to touch the visible part, in terms of defining some of the specific maternal complications that lead to neurologic damage. This has been compounded in part by the fact that in pediatrics we focus on a very limited, short-sighted goal, namely the establishment as widely as possible of intensive care nursery service, services that would be set up to handle referral of very sick infants from the community at large. In the long run, that is a real error. It is perfectly clear what the country needs, in the long run, are perinatal medical centers where high risk pregnancy patients, as early as possible, would be identified in the community at large and the mother handled at that perinatal health center throughout pregnancy, labor, delivery and post partum periods. It does not make sense to handle an infant two or three days after birth when he has gotten through the critical period when the highest neonatal mortality occurs and when we can offer nothing to that pregnant patient in terms of medical care and in terms of educating her of what is required for good medical care for subsequent pregnancies.

The U. S. perinatal mortality rate still lags behind a number of Western European countries. What is more disturbing, perhaps, is the fact that there are, in every state, in the union, pockets of very high maternal and infant mortality. Pockets with maternal mortality ten times the national average. While we can talk about the fact that we will not solve all our problems with perinatal medical centers, we must face the fact that you do not get maternal mortality and infant mortality that high without some very gross neglect in terms of overall medical care.

In southwest Colorado, there are a group of counties - while this is infant death rate the same thing would be true for perinatal mortality - where the mortality rate would be something in the order of over 40 per thousand, much higher than any national average. If we look at this one state and say how would we really dent the number of infants that are dying and the number of infants suffering damage during the pregnancy and after birth, it turns out that in absolute numbers the area around El Paso county would be a key place to focus on. For instance, all of these eight or so counties contribute twelve infant deaths per year. El Paso county contributes 105. So, while El Paso may have a slightly lower perinatal mortality rate of 39 per thousand vs. 45 or 46 per thousand in absolute numbers this would be a key place to focus. I would also point out it is not geographically isolated from Denver and of some interest is the fact that it, by no means, has the highest birth rate of the counties in Colorado.

In a country as wealthy as the U.S., if we wanted to turn to one single model of a perinatal medical center geared to handling virus pregnancy patients and right through the pregnancy, labor, delivery and neonatal period we have no single model, we can turn to in the country. We have schools and medical centers that are beginning to approach these by very slow and gradual steps. But, in fact, principally because of the kinds of direction that have been provided by government, we have no way we could turn to say how much would we really achieve in a large community in terms of improving maternal and infant mortality morbidity and how much would that cost. So that, while we can speculate that we might not significantly reduce some of the morbidity, it is pure speculation at this point since no community has served as a model.

To turn to what has come out in the last few years that is useful in helping provide better care for the mother and infant, I would like to turn to the end of the pregnancy first and spend the least time on this because it has receivedthe most publicity. The manipulative techniques have been aimed at pointing to the infant that is in fetal distress in-utero. These include continuous fetal heart rate monitoring in association with recording amniotic fluid pressures. The second is fetal scalp sampling and the third amninoscopy. The latter two techniques are good, clinical studies to point to what fraction of our infants with fetal distress would not be detected by conventional obstetrical techniques that will be detected by applying scalp sampling or amninoscopy. So, at this point, we certainly would not push to have this done by the obstetrical community at large. However, the evidence is very good in fetal monitoring and amniotic pressure monitoring that it is a help in detecting the infant that is getting in distress during labor. This is a very narrow part of the pregnancy of ten months, but it is still a very important part and it does make the induction of labor in the high risk pregnancy patient go along much more safely. The other area which is contributing greatly in medical care and, again, it is an area we hear little about is the barrage of correlations that are coming out of relating things we do to the mother during labor and delivery that produce clear neurologic signs in the newborn infant, i.e. intoxication of the newborn infant with local anaesthetics. It is becoming perfectly clear now that lethsolitocane and carbocane, the concentration in the umbilical vein blood of the baby is almost equal to the uterine veinous blood draining the placenta, the mother. In other words, these are agents that will be in equal concentration in the baby's blood as in the mother's blood, and there have been case reports of infants intoxicated with local anaesthetics presenting with severe convulsions and hyper-irritability that have responded with exchange transfusion and infants with markedly elevated levels of carbocane with general anaesthetics.

A second area of the study of the magnesium intoxication of the infant in those pregnancies where magsulfate is used for the treatment of toxemia. Again, an infant presenting with generalized convulsions treated with exchange transfusion for a clear cut intoxication.

Another area would be the evidence of severe water intoxication of the newborn infant during prolonged pertosin inductions of pregnant patients and the infant presenting with gross neurologic signs. And the same could be said, of course, of a whole variety of endocrinologic problems. The evidence of severe hypopalsemia and convulsions on that basis in newborn infants of mothers with hyperparathyroidism. And, so, what we are coming to is beginning to break down what was in effect the wastebasket diagnosis in pediatrics, mainly hyperirritability of the new born which was often ascribed to prematurity and we are now finding a variety of specific causes for this hyperirritability in the infant and the causes which are often treatable. Again, it points out the increasing usefulness of a very detailed medical history in careful obstetrical records throughout pregnancy but particularly around labor and delivery. If any of you enjoy mystery stories as much as I do, you know the classic example of the invisible man as being a postman who comes every day and I think this applies to local anaesthetics, to the use of five per cent glucose to pregnant patients and some of the things we are talking about here that are causing problems in newborns. It is very important that it is brought out to obstetrics at large that these can produce problems.

To turn to the earlier part of pregnancy, where we really ought to be focussing to a great extent, this is where we can really begin to dent mortality and morbidity rates. The problem resolves itself in great part, at least a good deal of the current research is focussed on recognizing deviations in interuterine growth retardation and I would agree it is a comparatively small percentage. This is a very common clinical problem that has gone unrecognized and, unfortunately, all of the surveys in the past that have related morbidity in later life in children to obstetrical complications have talked about prematurity in terms of birth weight alone. Even recognizing interuterine growth retardation, we must recognize that we are still dealing with a heterogeneous group, although it is a marked improvement over a definition by weight or size of the infant. Most of the rubella infants would be prematures by weight, certainly not prematures by post conceptual age.

Recently, I reviewed the ten-year survival rate, this is presented as a neonatal mortality rate, in Colorado General Hospital, 1958-1968, and I point out that, even in infants as small as 1,000 to 1,500 grams in general, the growth retarded more mature infant has a much lower mortality rate than a premature the same size. Here, we have a 60 or 50% mortality and 1,000 to 1,500 beyond 34 weeks, 13%. That gets more striking as we come up to bigger babies. We only had a mortality of 2% in infants from 1,500 to 2,500 grams who were term infants, term infants now, the both of those babies in that weight would be premature and the mortality rate was four times higher. Now, that is looking at mortality. If we go on to look at morbidity, we run into some, the immediate problem we run into, of course, is trying to find some data that sorts out infants of different degrees of maturity. It is silly to lump groups as heterogeneous as this and then talk about incidence of problems.

Now, Dr. Lubchenko has been kind enough to show me some very preliminary data of a four-year followup on children from our nursery service. This is our tenth and ninetieth percentiles of birth weight of 1,000, 1,500, 2,500 and this is gestational age. I point out to you, that, in our growth retarded babies at term, this is a 35% incidence of severe neurological handicaps, at 1,000 to 1,500 grams that up to 75% neurologic handicaps. Now, numbers are very small here, obviously, seventeen followup children in four. And this data is very, very slow in arriving at large numbers of infants if you want at least a four-year follow-up. But it points out the problem that the survival rate alone is not an adequate index and the thing that is disturbing to us particularly is that this would go back to babies in the nursery of 1964. When we looked at the incidence of one specific metabolic problem, hypoglycemia, which we know can cause neurologic damage, we found that the incidence in that year of hypoglycemia in babies of fixed gestations and birth weights was half the incidence we now have when we are routinely screening the growth retarded babies, regardless of symptoms throughout the first two days of life.

Since the problems of growth retarded infants have not been looked at very closely and we only have hypoglycemia as a specific metabolic problem that we have looked at, the most disturbing thing to me is to consider the fact that there may be other equally easily treated metabolic problems that these infants are presenting which we are not looking for routinely.

To come to the obstetrician and prenatal clinic, if he wants to recognize a deviation in growth rate there are two pieces of information he must have: First, an estimate of fetal size and second, of gestational age. In the nursery, it is comparatively easy to get an accurate measurement of the baby's weight and the pediatrician has the problem of obtaining an accurate estimate of gestational age. In prenatal clinic, however, the much more difficult thing to achieve is an accurate estimate of fetal size.

I present this table just to show you how short it is. We can have various techniques of abdominal palpation for the estimation of size. Ultrasound is going to be one of the most useful tools in obstetrics. Serial estimates of biparietal diameter should give an estimate of fetal size with an error generously estimated of 400 grams and to a lesser extent 24-hour urinary estriol. If we look at the tests available today in obstetrics to estimate maturity, we find that the list includes things as diverse as amniocentisis used diagnostically for createnine, bilirubin or percent fetal cells. We have recently completed a study in Colorado showing that if we measure all three of these simultaneously in amniotic fluids of women with very well established menstrual histories and gestational age estimates, the most reliable by far has been the createnine concentration. Endocrinologic tests are not accurate enough for an estimation of fetal maturity although these tests have been useful for an estimation of fetal health. Enzyme tests are more useful. Again, we have ultrasound estimates, biparietal diameter and again abdominal x-ray I would discard as a diagnostic tool. I do not think we need use it in light of the other tests available.

Now, postnatally, in addition to the neurologic exam of the newborn infant, there are specific objective data one can obtain, Developmental E.E.G. studies and evoked potentials have been shown to correlate with gestational age and peripheral nerve conduction velocities as well. The point, here, is not to say that there is a single test which could be relied upon exclusively for the estimate of fetal maturity before delivery, but rather to point out that the obstetrician is being provided with a barrage, a battery of tests for the estimation of fetal maturity and that as more and more tests become abailable to practicing obstetricians, we will face less and less the situation where an elective induction of labor goes on and, lo, and behold, a premature infant is delivered.

These are data from Dr. Hellman's report of biparietal diameters increasing with gestation, that is, the diameter of the head measured by ultrasound in pregnancy in a group of patients and showing in increasing head size as pregnancy advances.

With this review in mind, I would like to stress,then, that the striking discrepancies between the size of the uterus and the gestational age can be picked up even by relying simply upon abdominal palpation, particularly, if the patient has come to prenatal clinic early and by early means presenting prenatal clinic by the eighth week, certainly before the eighteenth week of gestation. On the basis of abdominal palpation and the menstrual history estimate of gestational age the most striking degrees of interuterine growth retardation can be picked up by the obstetrician before delivery. That is terribly important both in managing that pregnancy and in alerting the pediatrician because of the problems of these growth retarded infants being distinctly different from those of premature infants.

How to get this information disseminated to practicing obstetricians and pediatricians, and how do we get createnine concentrations used which is available in every hospital? How do we have more use of ultrasound diagnostically in obstetrics and how do we have heavier emphasis on careful history taking of drugs and medications throughout pregnancy? As well as during labor and delivery? We have to do this first, or, at least, simultaneously by developing medical centers that have functioning, real functioning, cooperation between obstetrics and pediatrics and not simply lip service paid by the neonatalogist or the obstetrician at that center about the need for cooperation. We need to have residents on the two services rounding daily on both services, so they are both aware of the problems in the house. This sort of thing. Secondly, I think, we have to begin to try to set up postgraduate teaching sessions that would aim at a joint audience of obstetricians and pediatricians. We have had conference after conference devoted to setting up an intensive care nursery and discussions of whether oxygen lines should be pulled from the wall or hung from the ceiling and I think we need more conferences aimed at presenting material which should be of joint interest to obstetricians and pediatricians and, again, since it has not been tried, I think, there will have to be a certain amount of error in learning along the way what kind of conference is most useful. In 1970, the Department of Obstetrics and Gynecology of the University of Colorado is going to try to give up its yearly postgraduate course in obstetrics and offer instead a one week course in perinatal medicine to pediatricians and obstetricians. What we are going to try at the first attempt is to offer during that week in the morning session a series of lectures on major topics in obstetrics and newborn medicine with an hour's lecture followed by an hour, an hour and a half discussion and then in the afternoons of this week present workshops where the obstetricians and pediatricians can get familiar with the current techniques, monitoring techniques, techniques of sampling and so on, and, perhaps, a few of them might even over coffee sit down together and talk about this and hopefully from communities obstetricians and pediatricians will come as groups to such a course. But, I think, we have to get started. Presenting material that is of joint interest to combined audiences and not only to physicians. One of the biggest blocks is, also, at the level of the nursing staff, on the delivery room and on intensive care nursery. That gulf is, at least, as wide as it is for the physicians involved.

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INTRAUTERINE DIAGNOSIS OF FETAL ABNORMALITY

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One of the really great changes in the practice of medicine and really the approach to the practice of medicine in the last decade has been in appreciation finally of the role genetics has to play in determining disease. Certainly, many of the conditions related to the central nervous system, mental deficiency, and many other life threatening conditions has, at the base, a simple nerve inheritance. It has been during this period that chromosome analysis has become familiar to common essentially in every single hospital really in the country. The specific defect in mongoloids, for example, has been identified as of lots of other chomosome abnormalities the concept of these being wrong in causing mental deficiency or birth defects have been alluded to really in the last decade and have become common place and finally what we have seen developed by the obstetricians and really now being taken over in another area has been the ability to detect the genetic defect *in utero*, specifically RH immunization, not only to detect it, but to be able to do something about it and treat it. It has really been this, the ability to go in and use this particular information which has opened up the area in which birth defects of all sorts could conceivably be detected *in utero*.

When one gets down to it, the vast majority of birth defects or familial disorders have, at present, really no suitable treatments and, at best, have simple models of prevention. In terms of the future, you have heard a lot, or read a lot about genetic engineering, and the place this may have, this is purely conjecture. There are no known examples of this as yet, but I have no doubt that there will be, at least, in some simple models of this present in the next decade or so.

Finally, one is left with what the physician has to utilize most of the time and that is to "restrict" what some people call undesirable genetic disorders and one can do this in either a form of genetic counseling to the parents before pregnancy and/or therapeutic abortion or an erruption of pregnancy.

The next thing which is commonly known to all of the approaches is that early detection is necessary. Where, in the last decade, early detection is necessary, for example, for diseases like phenylketonuria (PKU) and others have been in the newborn period in terms of screening procedures, we seem to be getting further and further back to where soon detection will mean even prior to conception.

Here, we have outlined schematically how one might utilize the material obtained from the amniotic fluid, the fluid surrounding the baby, to utilize this for detection of an abnormality of the fetus. One can obtain this material very safely early in pregnancy. One can, then, spin this material down and it separates into two easily identifiable fractions. The essential of fractions is cells which have been shed from the baby or cells from the amnion which are really fetal in origin or the remainder of the material, the supernatiant and this can be used in many ways. The first genetic defect picked up other than RH immunization in using this Dr. Berber inspired and this was a slide - a sort of adrenogenital syndrome - here, we have a baby - male or female - and the girls are masculinized - have enlarged clitorises - but it is not recognized in the newborn period because the child may die because he loses salt and dies in the adrenal insufficiency. This defect has been picked up of late in pregnancy by measuring the accumulation of abnormal metabolites in the amniotic fluid.

Another approach recently has been the suggestion that one might be able to detect which of the infants, which are going to be born, are going to develop the respiratory distress syndrome. On the basis of developmental pattern of the synethesis of lipid in this material some people have proposed that you would be able to select the baby who is going to develop respiratory distress syndrome after birth and, therefore, be able to take care of him much sooner. One can isolate virus in this material, this is an approach which has to be looked at more and more in terms of detection of whether the virus which the mother has been exposed to has, indeed, not only gotten across the placenta but into the fetal cavity in some way.

The area in which we spent time recently is the use of these desquamated fetal cells, amniotic fluid cells. They can be used directly for cytology to tell if we are dealing with boys or girls. It can be used for bichemical analysis directly. This is really only done in the last six months. There are now seven or eight genetic disorders which, immediately upon obtaining the amniotic fluid cells, one can detect in the fetus within an hour's time of running the assay and know whether one is dealing with a normal or abnormal baby.

Finally, one can grow these fetal cells and use them for biochemical analysis to pick up disorders like cystic fibrosis, galactocemia, or for chromosomal analysis.

You see schematically outlined the relative size of the uterus, the baby, the amniotic fluid early in pregnancy and by "early in pregnancy" we like to do it before eight weeks, but we really cannot. The time in which we routinely obtain amniotic fluid specimens are around the 14th week of pregnancy. At 12 weeks the amount of amniotic fluid is on the average of 75mm and this triples really in volume by 16 weeks during that period. The uterus at 12 weeks is just starting to come up above the pelvis and the obstetrician can feel it. It is more difficult, although it certainly can be successfully done to obtain the fluid then, but by fourteen or fifteen weeks it is much above it and is easy to do. The woman comes into the outpatient hospital under local anaesthetic, a needle is placed into the uterus - this is really very simple - and a small sample of fluid is withdrawn, the mother stays in the outpatient department for about 30 minutes and then goes home.

There have now been some 300 of these done in a number of centers. We have done about 150 and about somewhat over 100 of these have been done to monitor a high-risk pregnancy. This is "high-risk" in terms of the mother having a baby, who is going to have a particular type of genetic defect. Out of this group of patients, there are somewhat over a hundred of them, who have delivered babies after this procedure and in no instance has there been any damage to the mother. There are certainly complications which can occur from this procedure, but will probably be as safe in the average as the management of RH isoimmunization or amniocentenesis done for this late in pregnancy.

This shows the first approaches at genetic counseling using the cellular material and at the periphery of this cell here this little mass. In a normal male, who has 46 chromosomes, one x and one y, he does not have one of these and in a normal female, who has 46 chromosomes with 2 xx's, there is one of these and there is always one less than the number of x chromosomes. If one were to find this that, in general, one would predict that with a high degree of accuracy one is going to have a female infant. If one does not find these in the cells, one is dealing, in general, with a male infant. And this was first used some 10 or 12 years ago by Dr. Fuchs and Reese to manage pregnancies in which the women were of high-risk in having a child with an x link of recessive disorder, such as babies with hemophilia or muscular dystrophy. This particular woman, once she has delivered the child, has the risk of one in four in the subsequent pregnancy, but that one in four is none of her daughters and half of her sons. So, that instead of a risk of one in four if one will retain fluid from a woman who had a baby, for example with hemophilia and it were a girl, you could now tell her that her risks are no longer one in four, they are one in two. You have not established the diagnosis, but you have increased the precision of genetic counseling.

There are now, fortunately, a number of disorders like this in which you may be able to detect not say one and two but one in one. For example, we normally do not find the particular enzyme in amniotic fluid, the name is not important, but this is an enzyme which is elevated in patients with muscular dystrophy. Again, a disease inherited as an x link recessive disorder. We have recently seen a number of women who have been pregnant who had children with muscular dystrophy before, who in addition to being able to tell that they were going to have a boy on the basis of the sex-chromosome analysis were able to find increased levels of particular material suggesting that not only was it a boy, but it might very well be affected with a disease. In each of these instances, women have elected to interrupt the pregnancy, and we do not really know if we are correct. It will only be shortly, we hope, until we can really tell this.

Another kind of marker is a neurological disease which is rare, there are a number of them in which the children have a choreotaxic movement which is inherited as an excellent recessive. The family will have two or three boys affected and no daughters and without even knowing the name of one of these, we are able to detect in culture a different kind of marker which was abnormal. We have monitored two boys with this disorder and been able to both be sure that she was going to have a male and also that the cells had a particular disorder in them which the children who have this disorder have, although we do not know even the name of it, we are able to tell this family "yes" or "no" whether they are going to have another affected child.

This particular girl recently came to see us at Children's Memorial Hospital for genetic counseling and she came in at the age of 38, having just married with a history of having three siblings who had mongolism or Downs syndrome. She was married recently and she wanted very much to have children, but did not wish to assume the risk of having a child with this disorder. The first thing to do was to find out whether she was an increased risk by chromosome analysis. Normally, there are 46 chromosomes, but this particular woman had only 45. She is missing one of the chromosomes which fall in this group, and the reason she is is that this particular chromosome was hooked up on to one of these. This is called a translocation. We know that a woman who carries this does not have a random risk of whatever the risk of mongolism is in the population in which we will get to in a few minutes, but has a risk of about one in three of having a child affected with Downs syndrome. On the basis of this, she elected to have her pregnancy monitored and at 15 weeks or 16 weeks of pregnancy an amninocentesis was done. Instead of there being 45 chromosomes as the mother, there were 46 which is the normal number. There was a number of normal chromosomes in this G group, and there was an x and a y so it was a boy. But there was the translocation chromosome with an extra G hooked up there. This baby would have had mongolism. So, on the basis of that, the women and her husband elected to have this pregnancy interrupted.

Here is a photograph of the fetus having Downs syndrome which would not have been recognized. We were able to cultivate the cells from this fetus and show that the baby would indeed have had mongolism. And, fortunately, for her, three months afterwards she came back again pregnant and this time an amninocentesis was repeated at about 14 weeks of pregnancy, a sample was obtained and this time there were 46 chromosomes with two x's showing it would be a girl without the translocation of the chromosome. She has gone on to deliver a perfectly normal female. So, here is a woman who is an extremely high risk, one in three of having a child with Downs sydrome and she was able to select, in essence, the normal baby which she wishes to have.

One out of every 100 births or one out of 125 births now in this country is a child with a chromosomal aberration of some sort. For example, these are children who have an extra chromosome, mongolism is the most common. Mongolism occurs in one out of every 600 births in this country only - no matter what the particular economics status of the individual - whatever his racial background - happens to be, it makes no difference.

But this one in 600 is a deceptive figure. At the age of 25, the risk of any woman without a family history of mongolism having a child with this particular disorder and only about one in 2000. When the woman gets to be age 40, her risk is one in a hundred and when she gets to be 45, it is one in 50, one in 40. It becomes obvious that, with increasing age, she gets into a high risk category, and, as a matter of fact, there are in this country, for example, 8,000 infants born with mongolism last year. Of that group approximately half of 4,000 were born to women past the age of 35 or 36. It becomes perfectly obvious for counseling, and we could detect chromosomal abnormalities and congenital deformities go along together.

There are many women who would like to have children in this age (35-40) group, and there are many women, unknowingly to themselves, who can become pregnant. Women who have taken birth control pills, who go off the pills in their early 40's, and, subsequently, find themselves pregnant, did not realize they were at risk. Take the risk of a mongolism alone in the woman 40-45, for example, it is on the order of 1 to 2%. We have, in Chicago, instituted a study on this wherein two obstetricians' practices were studied, all women in that age group can elect to have an amniocentesis done and we have been doing this without any problems. So far, we feel that the risk of the procedures is less than the risk of the mother having a child with chromosomal aberration.

Finally, we are left with the environmental one, radiation for example, viral and growth. The next slide shows a series of high-risk genetic patients in terms of chromosomal abnormalities, which are monitored.

The translocation ones - these are women with risks one in three. Across the bottom, there are three other examples, which are very good. One is rubella, the first woman we looked at in this particular way, gave us some very good information. She was a woman who had had German measles in the first month of pregnancy. Amninocentesis was performed before her pregnancy would be interrupted, so that we could learn something and we found out not only was there an abnormality in terms of the chromosome - in terms of chromosomal breaks, which have been described in a number of virus infections. The fetus was missing in x chromosomes, but we were able to recover the virus from the cells in the amniotic fluid. This was able to show us that the virus had gotten across, and it obviously had had to infect the fetus for us to get it out of the cells in that culture. In this particular way, this might be useful to show whether the fetus had been exposed to the virus. We do not know this. It may be more useful in other kinds of viral infections.

Another group of patients which we have seen recently, girls or women who have taken LSD in pregnancy. There is much discussion concerning LSD and whether it can damage chromosomes. There is good evidence that LSD can have an effect in terms of breakage of human chromosomes, but we have no idea what this means. One dramatic instance was a patient in Chicago, who during the Democratic convention last year tried to jump out of a hotel room window. This was found by the Chicago Police Department to be socially unacceptable behavior, so they did the obvious thing they arrested her. She was found to be grossly psychotic and was admitted to a hospital where it was found that she had been taking tremendous doses of LSD and a variety of other agents for reasons totally unrelated to this to interrupt her pregnancy.

We were able to obtain the abortion material and the amniotic fluid all of which had all types of chromosomal breaks and rearrangements. We do not really know what it means at the moment. Any of the disorders which, in the past, and either genetic disorders associated with chromosomal breaks have always had an increased incidence of leukemias. We have no idea what the genetic impact in future generations might be.

The last one is an example of where one just uses sex chromosomes to predict the sex, one can be wrong. This particular girl listing an x chromosome would have an absence of sex chromosome in her body and, indeed, she did. This is a woman who had a child with hemophilia and an amninocentesis was done in New York. She was told she was going to have a boy. The mother elected not to interrupt the pregnancy and at about 7 or 8 months pregnancy moved to Chicago, where she came under our care. We were able to obtain an amniomnic fluid specimen. There was an absence of one sex chromosome, but if you counted the chromosomes you found that there were only 45 instead of 46. This particular woman, who was expecting delivery of a boy, delivered a girl instead who is missing an x chromosome. This is one of the inherent risks of using the less accurate test of the two.

This is an infant, who has died with galactosemia, a disease where the patient cannot metabolize lactose. The child becomes jaundiced and has vomiting, diarrhea, liver disease and may die in the first few months of its life. If he does not die, the major defect in this group of patients is that at ages 10 and 11, they have "minimal brain dysfunction". Their IQ's are essentially in the normal range, almost the same as their peers, but the children are always one or two or three grades behind at school. They have difficulty concentrating. If the condition is recognized in the newborn period, one can treat it very simply by removing lactose from the diet. The child then survives. Even though he survives, he may have some minimal deficit later one. Why should one want to make this diagnosis in utero, since you can detect it at birth, and it can be treated appropriately? Even with optimal treatment the children are not up to the level of their siblings. Also, for example, if this particular girl could become pregnant, she would obviously have to be treated during her pregnancy or conceivably the fetus that she was carrying might get into difficulty. The pregnancy might be interrupted on this basis. But, there is another reason for presenting this and this is really where the future in this area is going to be. Obstetricians routinely, if they recognize this, will put the women, who have had a previous child with galactosemia, on low lactose intake. Here, you have a good example of how to develop a whole variety of approaches to treat diseases in utero which will prevent serious morbidity and mortality later on. This is where the obstetrician and the pediatrician are going to have to combine their talents in order to look at this because this is an area which in the next decade you will see more and more developed.

Here is a different type of disorder. This is a disorder where children died three months of age. This child has a large pale stained heart and the reason for this he cannot handle his glycogen load normally. This is a disease inherited as an autosomal recessive. Both parents are carriers and, therefore, have a 1 in 4 risk in any subsequent pregnancy.

This is a cell stained with a substance called, or a material called, toluene blue and if you will notice the cytoplasm, there are not many granules. We see cells obtained in amniotic fluid from a woman. This had nothing to do with our genetic studies, but it was obtained from a woman for RH isoimmunization problems and was used really as a control in helping us learn how to grow cells. We stained it and found this abnormality. At that time, this had only been shown to be present in one disorder - mucopolysaccharides, Hurler's syndrome. We were able to predict that this woman would deliver an infant with this particular disorder.

This is a photograph of a baby at 6 or 7 months of age with a deformity of the back, a protruding abdomen, with an enlarged liver and spleen. These children develop progressive central nervous system manifestations, mental retardation and usually die between 5 and 10 years of age. There have been now some five or six patients with this disorder which have been picked up in utero at the National Institutes of Health. We have been able to pick up three of them early in pregnancy in time for the parents to be able to use this information for counseling.

There are other disorders which we can detect in utero, such as cystic fibrosis. This is the single most common lethal gene amongst caucasians. One out of every 2,500 births in this country amongst whites is an infant born who has cystic fibrosis. One, out of every 25 in this room, is a carrier of this particular disorder. We can now recognize carriers. We can tell you before you become pregnant whether or not you are a carrier and this is how potential problems get pushed back further and further. Identification of the woman and husband at high risk, then,conceivably, identification of the fetus.

We have made progress in the last few years in this area, but have only scratched the surface. The vast majority of birth defects, other than things like chromosomal abnormality,still have to be solved. The parent, who has a child with central nervous system defect, myelomeningocoele or hydrocephalus, needs assistance - since, at present, we have no way of detecting this in utero. But we do have ways in which to manage these patients better and this is not being done.

When members of this panel were in medical school, nobody talked much about genetics. There was no exposure to this type of approach. Given a child, for example, who has a myelomeningocoele defect in the back, enclosure of the spine alone, this occurs in this country somewhere in the order of three out of every thousand births. This particular woman in 99.9% of practical medicine today, once she has delivered such an infant will either never ask the question or never be told what her risks are in subsequent pregnancy. She may ask the question, and she is invariably told that she has had bad luck. The vast majority of women who have had a mongoloid child have had bad luck with not an appreciable risk. There are some who are not and they have to get some idea of what this risk is. This woman no longer has a risk of 3 in a thousand, she has a risk of 3 in a hundred and this three in a hundred is made up of a whole group of women, some of which really have a risk of less than 3 in a thousand and some of which have a risk of one in four. This is the group of patients if properly counseled at least the parents can have some concept of what they are getting involved in. In this way, conceivably, certain types of birth defects can be prevented from occuring. These are the kinds of approaches which are a fundamental necessity to birth defect centers and to genetal malformation programs. The cerebral palsy clinic has really been neglected up until the present time, both because of non-availability of personnel trained in this area and, also, because it is not a very pleasant subject.